Executive Summary

Elementary School One underwent modernization in 2010, renovating the existing building and adding an addition to the west side of the building. The existing building was built in 1925 and is currently listed on the National Register of Historic Places. The addition adds four floors with three above grade. The addition includes classrooms, a multipurpose room, and a library.

The mechanical system installed was a VRF system with air-cooled condensers that condition most spaces. Those spaces are also served by three DOAS units ducted to VAV boxes in each space. The rest of the spaces are conditioned by rooftop packed units and split system AHUs.

Proposed Alternative

The proposed alternative is to have water-cooled VRF units with a ground coupled heat pump. The goal of this design is to increase building efficiency and reduce operating cost. A combination of Trace 700 modeling and hand calculations determined the building loads and energy consumption. The alternative system reduces the yearly energy consumption cost by $35,431.19 and reduces emission by 21%. The initial cost difference is an increase of $566,215.69 with the 10% Federal Rebate. The payback period with the rebate is 15.98 years and 19.58 years without. The alternative system is recommended, especially for a long-term owner such as the school district. This system will be saving money on the utility bill for a long time.

Construction Breadth

The impact of the alternative system on the construction cost, schedule, and site operations was investigated. It was found that the initial cost was increased by $566,215.69. The installation of the ground coupled system was 80 days more than the original system, but the schedule would only be impacted for 25 days due to the location of installation. The site layout was only temporarily affected for those 25 days where portables had to be relocated.

Acoustical Breadth

The acoustical comfort of the multipurpose room and cafeteria were investigated using Dynasonic Software. The multipurpose room is served by two RTUs and the noise criteria was much greater than comfortable level, NC->65. The multipurpose RTUs needed acoustical treatment of 2 in duct lining and two duct silencers to reduce to under NC-45. The cost of these treatments total to $16,157. The cafeteria NC levels were only slightly over the preferred level, NC-52 to NC-45. The recommended treatment for the cafeteria is two duct silencers coming to a cost of $4000. The cafeteria doesn't need the treatment because the rooms are not learning spaces.